

We claim:

1. A method for restoring a service path in a network, said service path having a pre-computed restoration path, said pre-computed restoration path having at least one segment, said

5 method comprising the steps of:

detecting a restorable failure along said service path; and

signaling the restoration of said failure using at least one signaling path that occupies the same bandwidth as said pre-computed restoration path, each of said at least one signaling paths being replaced by a segment of said pre-computed restoration path after signaling is complete.

2. The method of claim 1, wherein said network is a SONET network.

3. The method of claim 1, wherein said network is an SDH network.

4. The method of claim 1, wherein said network is an optical network having nodes capable of accessing digital overhead on said paths.

5. The method of claim 1, wherein said signaling step is initiated by an end-node along said service path.

6. The method of claim 1, further comprising the step of distinguishing a restorable failure from a non-restorable failure to determine whether to activate said restoration.

7. The method of claim 1, wherein a signaling message is transmitted in an overhead portion of said at least one signaling path.

8. The method of claim 1, wherein a signaling message is transmitted in a payload portion of said at least one signaling path.

9. The method of claim 1, wherein a signaling message identifies said service path having said failure and requests the establishment of said pre-computed restoration path.

10. The method of claim 9, wherein said signaling message is relayed from one restoration node to another node in the overhead or payload of said at least one signaling path, based on an identity of a failed service path identified in said signaling message.

11. The method of claim 10, further comprising the step of establishing a cross-connect that replaces said at least one signaling path with a segment of the pre-computed restoration path requested in the signaling message, said establishing step being performed after relaying said signaling message to a subsequent restoration node.

12. The method of claim 1, wherein said signaling path transits non-conforming network elements.

13. The method of claim 1, wherein a non-restorable failure is indicated using a flag in a path overhead field.

14. The method of claim 1, further comprising the step of determining if said failure is a restorable failure using criteria from the ANSI Tandem Connection Maintenance standard.

15. The method of claim 1, wherein said network is a restorable network within a larger multi-network environment and wherein said signaling step is initiated only when the fault causing said path failure is located within the restorable network.

16. The method of claim 1, wherein customer path terminating equipment is not part of a restorable network, and wherein said signaling step is initiated only when the fault causing said path failure is located within said restorable network.

17. The method of claim 1, wherein adjacent restoration nodes in said network initiate and terminate paths that are used for signaling in spare network bandwidth, wherein said signaling paths remain in place for signaling until replaced by said pre-computed restoration paths used to restore service.

18. The method of claim 1, wherein end nodes are identified for said service path when said service path is initially provisioned.

19. The method of claim 18, wherein said end nodes monitor for said path failures and initiate restoration signaling only when said path failure is due to a fault located between the end nodes.

20. The method of claim 18, wherein said end nodes (i) formulate a restoration message uniquely identifying said failed service path and requesting set-up of said pre-computed restoration path, and (ii) route said message to a subsequent restoration node.

21. The method of claim 18, wherein said end nodes permits traffic to flow out of the network on a restored path only after verifying both end node-to-end node connectivity and an identity of the restored path.

22. A method for restoring a service path in a network, said service path having a pre-computed restoration path, said pre-computed restoration path having at least one segment, said method comprising the steps of:

detecting a failure along said service path;
determining if said failure is a restorable failure;
signaling the restoration of said restorable failure using at least one signaling path that follows said pre-computed restoration path, said pre-computed restoration path segments replacing said at least one signaling paths after signaling is complete; and
connecting said pre-computed restoration path.

23. The method of claim 22, wherein said network is a SONET network.
24. The method of claim 22, wherein said network is an SDH network.
- 5 25. The method of claim 22, wherein said network is an optical network having nodes capable of accessing digital overhead on said paths.
26. The method of claim 22, wherein said signaling step is initiated by an end-node along said service path.
27. The method of claim 22, further comprising the step of distinguishing a restorable failure from a non-restorable failure to determine whether to activate said restoration.
- 15 28. The method of claim 22, wherein a signaling message is transmitted in an overhead portion of said at least one signaling path.
29. The method of claim 22, wherein a signaling message is transmitted in a payload portion of said at least one signaling path.
- 20 30. The method of claim 22, wherein a signaling message identifies said service path having said failure and requests the establishment of said pre-computed restoration path.
- 25 31. The method of claim 30, wherein said signaling message is relayed from one restoration node to another node in the overhead or payload of said at least one signaling path, based on an identity of a failed service path identified in said signaling message.
32. The method of claim 31, further comprising the step of establishing a cross-connect that replaces said at least one signaling path with a segment of the pre-computed

restoration path requested in the signaling message, said establishing step being performed after relaying said signaling message to a subsequent restoration node.

33. The method of claim 22, wherein said signaling path transits non-conforming network elements.

34. The method of claim 22, wherein a non-restorable failure is indicated using a flag in a path overhead field.

35. The method of claim 22, further comprising the step of determining if said failure is a restorable failure using criteria from the ANSI Tandem Connection Maintenance standard.

36. The method of claim 22, wherein said network is a restorable network within a larger multi-network environment and wherein said signaling step is initiated only when the fault causing said path failure is located within the restorable network.

37. The method of claim 22, wherein customer path terminating equipment is not part of a restorable network, and wherein said signaling step is initiated only when the fault causing said path failure is located within said restorable network.

38. The method of claim 22, wherein adjacent restoration nodes in said network initiate and terminate paths that are used for signaling in spare network bandwidth, wherein said signaling paths remain in place for signaling until replaced by said pre-computed restoration paths used to restore service.

39. The method of claim 22, wherein end nodes are identified for said service path when said service path is initially provisioned.

40. The method of claim 39, wherein said end nodes monitor for said path failures and initiate restoration signaling only when said path failure is due to a fault located between the end nodes.

5 41. The method of claim 39, wherein said end nodes (i) formulate a restoration message uniquely identifying said failed service path and requesting set-up of said pre-computed restoration path, and (ii) route said message to a subsequent restoration node.

42. The method of claim 39, wherein said end nodes permits traffic to flow out of the network on a restored path only after verifying both end node-to-end node connectivity and an identity of the restored path.

43. A system for restoring a service path in a network, said service path having a pre-computed restoration path, said pre-computed restoration path having at least one segment,
15 said system comprising:

a memory for storing computer-readable code; and
a processor operatively coupled to said memory, said processor configured to:
detect a restorable failure along said service path; and
signal the restoration of said failure using at least one signaling path that occupies
20 the same bandwidth as said pre-computed restoration path, each of said at least one signaling paths being replaced by a segment of said pre-computed restoration path after signaling is complete.

44. A system for restoring a service path in a network, said service path having a pre-computed restoration path, said pre-computed restoration path having at least one segment, said
25 system comprising:

a memory for storing computer-readable code; and
a processor operatively coupled to said memory, said processor configured to:
detect a failure along said service path;
30 determine if said failure is a restorable failure;

signal the restoration of said restorable failure using at least one signaling path that follows said pre-computed restoration path, said pre-computed restoration path segments replacing said at least one signaling paths after signaling is complete; and connect said pre-computed restoration path.

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